

REMARKS

Reconsideration of the above-identified application, as amended, is respectfully requested.

In the Office Action of December 12, 2005, which has been made FINAL, the Examiner finally rejected Claims 1, 2, 4-7, 9-11 and 18 under 35 U.S.C. §103(a), as being allegedly unpatentable over Sugawara et al. (U.S. 5,438,421) in view of Bryan-Brown et al. (U.S. Patent No. 5,917,570). In the present Official Action, Claims 3 and 8 were further rejected based upon the combination of Sugawara in view of Bryan-Brown and in further view of Callegari et al. (U.S. Patent No. 6,020,946).

In response to the rejection of independent Claim 1, Applicant amends Claim 1 to set forth a liquid crystal display (LCD) device comprising: a first substrate having a grooved surface profile; and, an alignment film layer of inorganic or organic material formed on said grooved surface and having said grooved surface profile, the alignment film of inorganic or organic material being subject to an ion beam incident to said grooved surface in a direction parallel to a groove direction to thereby eliminate 90° meta-stable alignment states at the surface of said alignment film layer resulting in an increased alignment force for constraining deposited LC material to a direction parallel to the grooves; and, a second substrate aligned opposite said first substrate for forming a plurality of LCD cells having the liquid crystal (LC) material deposited therein, wherein LC molecules align parallel to the grooves for enhanced LCD performance.

While entry of this amendment is not by matter of right, Applicants respectfully submit that the limitations currently being added to Claim 1 are for purposes of clarifying the inventive subject matter and have been engendered by content in the Examiner's Response to

Arguments section (pg 6, et seq.) in the current Office Action and could not have been earlier presented. It is thus respectfully requested that the current amendment be entered.

Respectfully, no new matter is being entered by this amendment with full support found in the specification, e.g., at page 4, ¶[0013] and page 6 ¶[0023].

It is respectfully submitted that Claim 1 as now amended sets forth a liquid crystal display (LCD) device that is clearly distinguishable over the combination of Sugawara and Bryan-Brown, whether taken alone or in combination.

Both of these cited prior art references appear to suggest use of ion beam (IB) treatment to shape the form of the surface of the film. These teachings do not contemplate use of IB treatment for the purposes of creating better LC material alignment and more stability of LC material (for enhanced performance) as used in the present invention as claimed in amended Claim 1.

Thus, for example, contrary to the Examiner's citation of Sugawara (Fig. 5(c), col. 11, line 55), the arrows indicated in Figure 5(c) of Sugawara indicate ion beam treatment for the purposes of surface etching, i.e., tailoring a surface so to provide an irregularity, e.g., a triangle peaked convex portion as shown in a cross-section view of Figure 5(c). To achieve this, it is noted that in Sugawara (Fig. 5(c), the arrows shown in Figure 5(c) are perpendicular or transverse to the grooves already formed on the surface and therefore only represents a technique for tailoring a grooved surface profile (to render it more irregular with a triangular apex (rather than sinusoid) as shown in the cross-sectional view of Figure 5(c)). There is no absolutely no teaching or suggestion that such ion beam etching as depicted in Figure 5(c) of Sugawara has any effect on alignment force or orientation of the LC molecules.

However, the Examiner argues in the Response to Arguments section of the Office Action that any ion beam incident on a grooved surface ultimately generates an increased

alignment force on the alignment of LC material (page 8 of Office Action). While inherently any ion beam etching will alter characteristics of a material at a microscopic level, the present invention recognizes the advantageous results from an Ion Beam treatment that is incident to a grooved surface in a direction parallel to a groove direction which thereby eliminates 90° meta-stable alignment states at the surface of said alignment film layer resulting in an increased alignment force for constraining deposited LC material to a direction parallel to the grooves. Thus, it is respectfully submitted is a structural difference at the microscopic level that is neither taught nor suggested by Sugawara whether taken alone or in combination with Bryan-Brown or Calligari. That is, the combination of the prior art teachings do not teach or suggest a LCD device having grooved surface profile with 90° meta-stable alignment states eliminated as a result of an ion beam etching step.

Respectfully, Bryan-Brown is of no help in this regard. Bryan-Brown pretreats surface with bigrating to achieve a surface pre-tilt. The "exposure" described in Bryan-Brown is a light exposure and development to form a bigrating in the surface of the resist to form having asymmetric grooves profile such that a desired pre-tilt angle is achieved (see Bryan-Brown, col. 5, lines 29-45. By making the grooves asymmetric various degrees of pre-tilt (of LC material are achievable near the grooved profile surface (See Fig. 5a) according to the application and LC material used. Respectfully, the combination of Sugawara and Bryan-Brown does not teach or suggest the LCD device structure having an alignment layer treated by low energy ion beam processing such that 90° meta-stable alignment states at the surface of said alignment film layer are eliminated.

Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection of amended Claim 1 under 35 U.S.C. §103(a) and to withdraw the rejection of all claims dependent upon Claim 1 by virtue of their dependency.

In view of the foregoing remarks herein, it is respectfully submitted that this application is in condition for allowance. Accordingly, it is respectfully requested that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the Applicants' attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,



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